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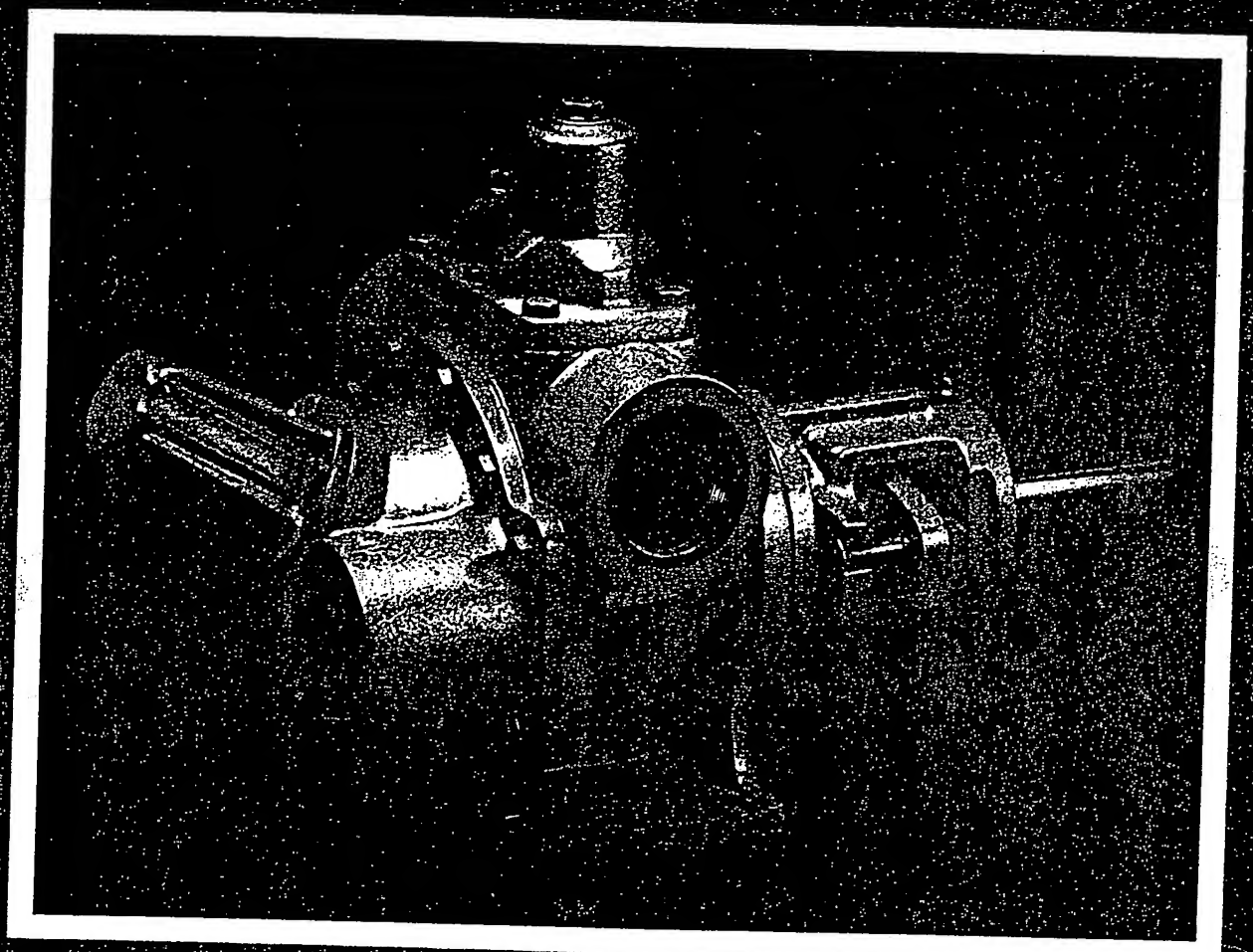
GRANCO



What Makes Granco Rotary Ball Pumps Run...

The secret is the unique, floating Granco rotor. Pivoted in a spherical housing, the rotor provides positive expulsion of fluid from the pump chamber directly into the line of flow. The simplicity of the Granco design provides excellent fluid displacement without the use of gears, blades, vanes, paddles, scoops, pistons, valves or stators.

and Run...

A standard Granco rotary ball pump can move a tremendous variety of fluids with viscosities ranging from 30 to 1,000,000 SSU without modification of standard clearances. Product ranges include:

PETROLEUM - from solvents through crude and lube oils.

INDUSTRIAL - from water-based paints through caulking compounds.

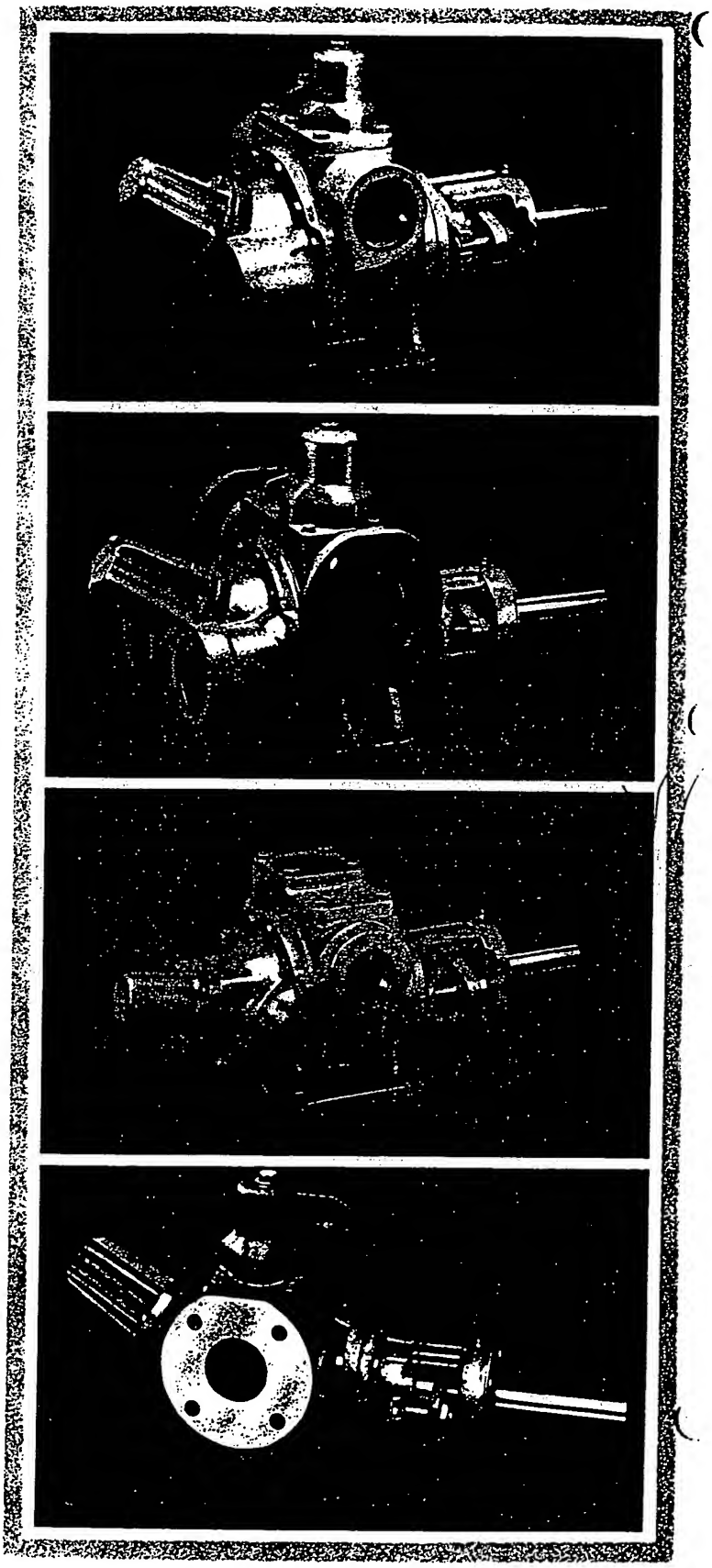
EDIBLE - from vegetable oils through molasses and peanut butter.

and Run...

The Granco rotor has four large pumping chambers. These individual chambers are positioned so that incoming fluids flow directly to the heart of the rotor. Since fluids enter and exit the rotor cavities with less friction and less shear, the Granco pump displaces more product with greater efficiency than other designs. Gallon for gallon, Granco pumps will normally deliver more product at the same speed and require less horsepower than other positive displacement pumps.

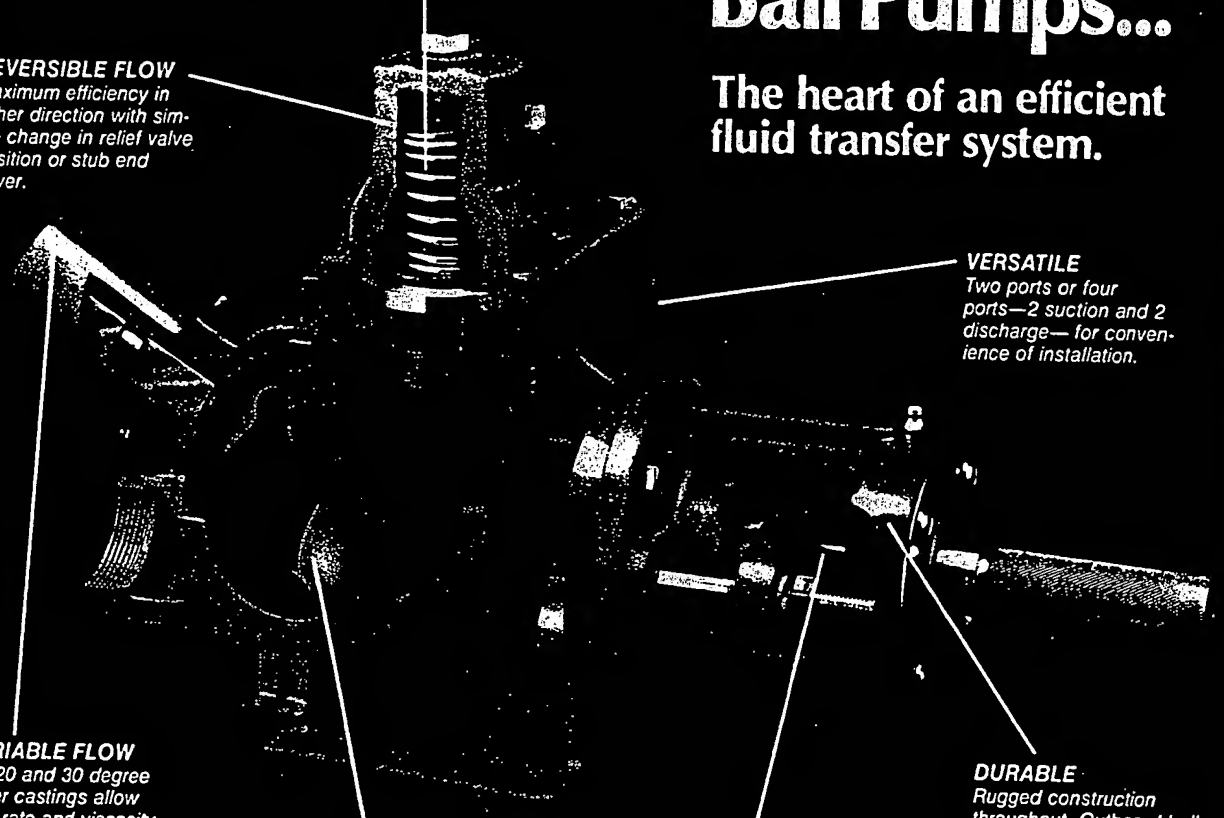
and Run?

The performance of a positive displacement pump depends upon maintaining the tolerances of the pumping mechanism. Operating speed attacks these tolerances. The floating Granco rotor minimizes metal to metal contact in the pump. The large rotor cavities allow the Granco pump to operate at lower rpms. These features combine to preserve the pump's original tolerances. Thus, the Granco pump will run slower and longer and require less ongoing maintenance.



Granco Rotary Ball Pumps...

The heart of an efficient fluid transfer system.



DEPENDABLE
Built-in, adjustable relief valve with dashpot action permits operator to close discharge without stopping pump.

REVERSIBLE FLOW
Maximum efficiency in either direction with simple change in relief valve position or stub end cover.

VERSATILE
Two ports or four ports—2 suction and 2 discharge— for convenience of installation.

VARIABLE FLOW
10, 20 and 30 degree cover castings allow flow rate and viscosity adaptation.

UNIQUE DESIGN
Rotor with universal joint action for smooth, steady flow.

ADAPTABLE
Available with packing or mechanical seal.

DURABLE
Rugged construction throughout. Outboard ball bearing as standard.

GRANCO

KEEPS THINGS MOVING

ROTARY BALL PUMPS

COMPARE THESE FEATURES - YOU GET THEM ALL WITH GRANCO

One simple rotor, a patented application of the universal-joint principle, suspended in spherical housing, does not depend on metallic contact for pumping action. No gears, blades, scoops, buckets or valves to wear out. The Granco rotor provides positive expulsion of liquid directly into line of flow.

Built-in relief valve with dashpot action is chatterproof and easy to adjust.

Outboard ball bearing supports main shaft.

Compact — Granco Mounted Pumps take up less space per capacity than other designs.

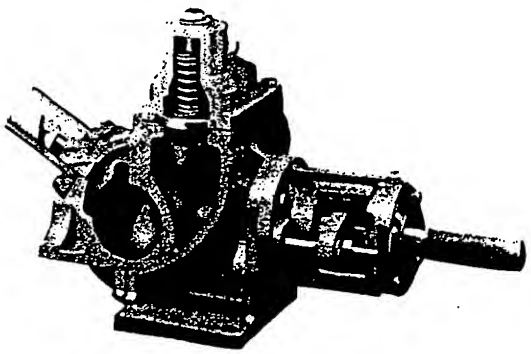
Reversible Rotation — Granco Pumps work equally well in either direction. Rotation may be reversed simply by reversing the drive direction or the angle of the stub shaft.

Unequalled dry suction and high vacuum obtained with Granco Pumps assures the first and last drop of liquid will be taken from your tank without priming or bleeding.

Sturdy construction of Granco Pumps insures lasting, economical service.

SPECIFICATION TABLE

Model	Size In.	Max. Cap. GPM	Max. RPM	Weight Lbs.
D	1½	60	500	63
DE	2	90	750	65
E	2	120	600	87
EL	2½	150	750	97
HF	2½ x 3	200	400	162
H	3 Fl.	300	600	198



Granco Pump Internal Configuration

One pump for all applications.

A standard Granco rotary ball pump can move a tremendous variety of fluids with viscosities ranging from 30 to 1,000,000 SSU without modification of standard clearances. Product ranges include:

PETROLEUM - from solvents through crude and lube oils.

INDUSTRIAL - from water-based paints through caulking compounds.

EDIBLE - from vegetable oils through molasses and peanut butter.

Low downtime, maintenance costs.

The performance of a positive displacement pump depends upon maintaining the tolerances of the pumping mechanism. Operating speed attacks these tolerances. The floating Granco rotor minimizes metal to metal contact in the pump. The large rotor cavities allow the Granco pump to operate at lower rpms. These features combine to preserve the pump's original tolerances. Thus, the Granco pump will run slower and longer and require less ongoing maintenance.

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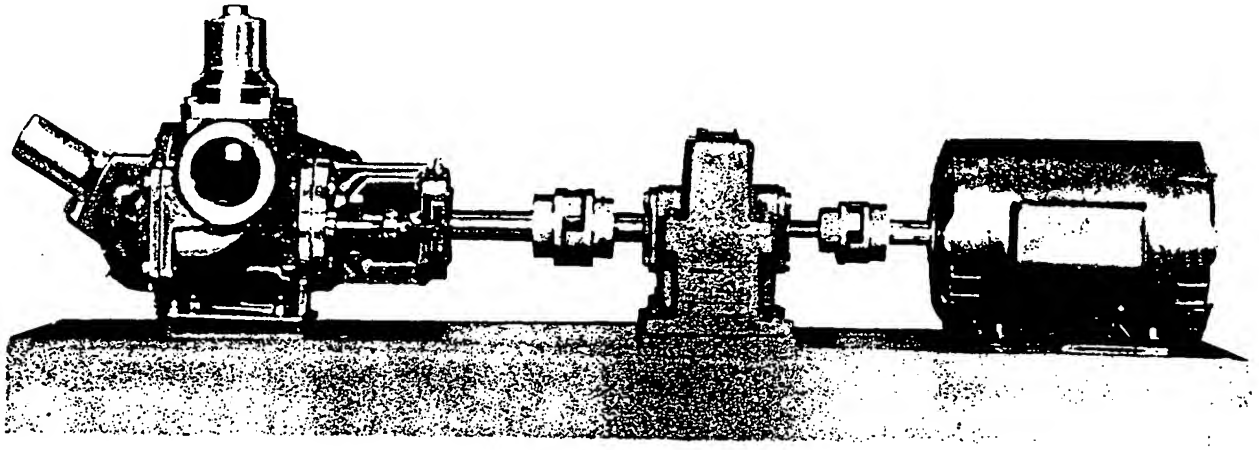
GRANCO
CHALLENGE MANUFACTURING CO., INC.
OF LOUISIANA
1308 67TH STREET • OAKLAND, CA 94608
(415) 652-8847 TELEX NO. 17-1236

Mounted Units



GRANCO MOUNTED PUMPS are ideal for bulk transfers of petroleum products and a variety of other liquids. All units are securely mounted on heavy steel bases and are easily adapted to any type of power source. Performance is smooth and quiet, with no vibration when properly installed. All pump models have rugged, cartridge-type outboard ball bearings and are furnished with two ports as standard. Four port pumps are available upon request. Compare small space requirements and efficient operation of Granco mounted units — you'll find Granco your best buy in pumping equipment!

GRANCO PUMPS WITH GEAR REDUCER DRIVE have totally enclosed reduction gears running smoothly in oil-tight gear housing. (See photo above.) Size of motor will depend on gallons-per-minute required, viscosity and temperature of the liquid and total dynamic head. The unit is of compact design and requires minimum mounting space.

GRANCO PUMPS WITH MULTI V-BELT DRIVE are adaptable to a wide range of speeds as required for pumping liquids of various viscosities. Slide rails are furnished, permitting quick and easy adjustment of drive tension.

GRANCO MOUNTED PUMPS are available with gear motor drive, variable speed drive, torque limiter drive and gasoline engine drive. Contact the factory or your distributor for details.

GRANCO PUMPS available for truck mounting or mounting to your base and drive.

Granco four port pumps (ideal for truck applications to minimize manifold piping) are available in models DD, DE, E, HF and H. Not available in model EL

Granco pumps are manufactured in several materials to cover a wide range of applications. Standard materials include iron, iron and bronze, bronze and stainless steel, iron and ni-resist, and ni-resist and stainless steel.

WHEN ORDERING . . . pressure, gallons-per-minute required and type of liquid to be pumped are essential information . . . also give electric characteristics of motor required.

GRANCO
Division of Challenge Manufacturing Co., Inc.
1308 67th STREET
OAKLAND, CA 94608
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Principles of operation and
performance characteristics of

Rotary Ball Pumps

By **MICHAEL L. GEORGE**, Challenge Manufacturing Co., Inc., Oakland, CA

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The magazine that helps plant engineers solve their everyday problems

Principles of operation and performance characteristics of

Rotary Ball Pumps

By MICHAEL L. GEORGE, Challenge Manufacturing Co., Inc., Oakland, CA

The heart of any fluid transfer system is the pump. It is important that pumps be chosen for their ability to perform efficiently without changing the properties or composition of the pumped fluid. The gentle squeezing action of a rotary ball pump makes it ideal for handling viscous, shear-sensitive products.

A rotary ball pump rotor looks like the first cousin of a universal joint. The rotor consists of three mated pieces on a rotating shaft supported by two bushings, Fig. 1.

The rotor forms four cavities— two opening and two closing. These cavities operate 90 deg out of phase with each other, in a spherical housing, as the shaft rotates. This design provides positive fluid displacement without using gears, blades, vanes, paddles, scoops, pistons, valves, or stators. The bushing support of the rotor allows it to float in the pumping chamber. This floating action reduces wear caused by metal-to-metal contact between the pumping mechanism and the pump chamber in more conventional designs of positive displacement pumps.

Rotary ball pumps deliver repeatable flow rates throughout the normal speed range between 50 and 750 rpm. Lower operating speeds reduce the number of rotor cavity openings and closings per minute and thus lower the output.

The pump is self-priming and will develop a vacuum of 25 in. Hg. However, this priming ability diminishes as speed is reduced. The basic displacement is not affected when the pump is driven by any standard drive. Operation in either direction of rotation does not affect flow rate, suction capability, or pump life, Fig. 2.

The discharge rate of a particular pump in a given application is affected by the viscosity of the pumped fluid, the discharge pressure of the system, and pump speed. Pump speeds must be reduced as product viscosities increase in order to prevent possible cavitation. High discharge pressures increase internal pump slippage as product viscosity decreases.

Rotary ball pumps can be built in gray iron, bronze, chrome-nickel, nickel cast iron, or combinations of these materials. The all bronze construction is commonly used on water, liquid sugar, and syrup service. The nickel cast iron construction is normally used in abrasive services or for handling sour crude oil and salt water mixtures. The advantage of this construction is its high resistance to abrasion and corrosion at a cost substantially below that of stainless steel.

Direct fluid flow into the center of the suction cavities of the rotor reduces friction. Fluids enter the pump rotor with less shearing than occurs in most positive displacement pumps. This unimpeded flow reduces friction and heat buildup while maintaining product stability. The discharge action of the rotor gently squeezes the trapped fluids to expel them. This unique action contributes to the low shear stress imparted by the pump to shear-sensitive products. The pump may be used with pairs of suction and discharge ports for blending from separate suction lines, for flushing with a normally unused line, for discharging into two separate systems, or for plumbing for two separate, but compatible batch operations, Fig. 3.

Three products for which a low shearing rate is advantageous are fire-fighting foam, bread dough, and oily water feed mixture for oil-water separators. Fire-fighting foams require gentle treatment so that concentrate is pumped instead of being foamed within the pump. Bread dough must be handled with as little shear as possible so that temperature and consistency fluctuations do not retard the rising process. Oily water mixture must be pumped with as little turbulence as possible so that oil emulsification is kept at a minimum.

Rotary ball pumps also handle compressible solids that may clog and stall many positive displacement pumps. The squeezing action of the rotor cavities in the discharge mode easily pass compressible solids. The rotor cavities do not close 100 percent, so some larger solids can be passed without creating excessive strains within the rotor. Centrifugal force also improves the solids-handling ability of the pump by tending to expel particles toward the discharge ports.

The ability of a rotary ball pump to handle solids can be altered by changing the angle of closure of the rotor. The standard 30 deg cover is replaced with a 10 or 20 deg cover that reduces the amount of closure. The cover angle is the angle between the smaller elevated stub

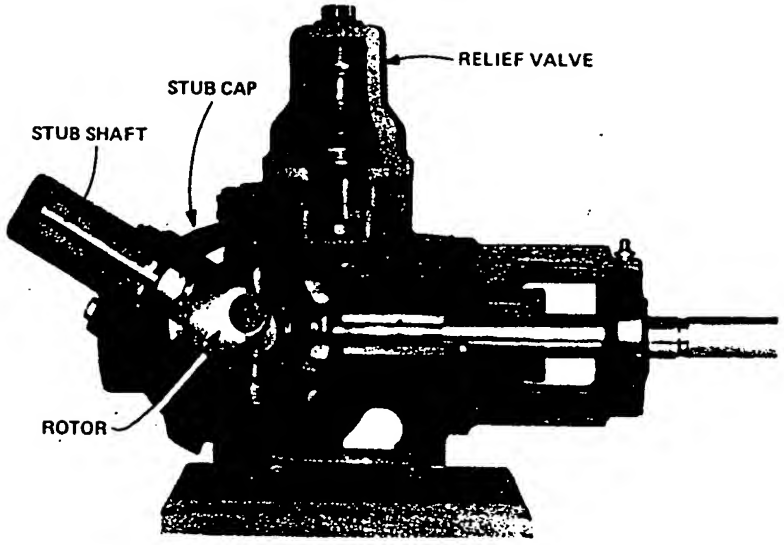

Fig. 1. The displacement of this pump per input shaft revolution is determined by the angle of the stub shaft shown on the left. A 30 deg angle is standard, and 20 and 10 deg are available for handling varying viscosities. Capacity is reduced by one-third with the 20 deg cover and by two-thirds with the 10 deg cover.

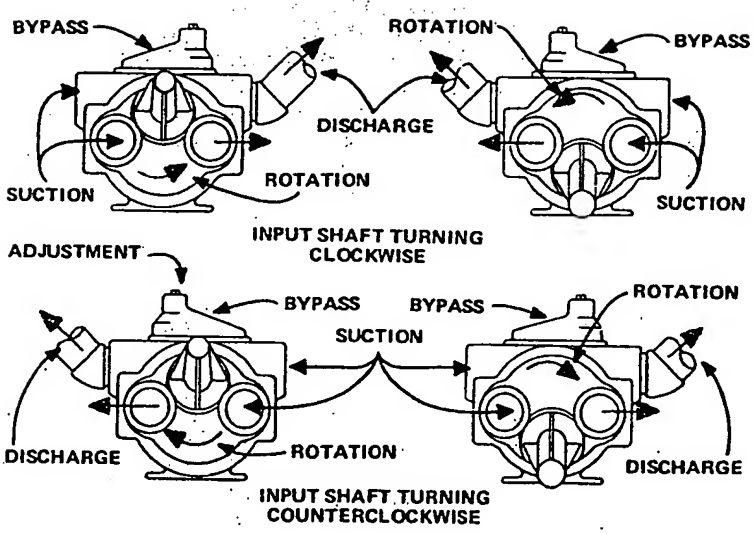

Fig. 2. The direction of flow in this positive displacement pump can be reversed in two ways: by reversing the rotation of the input shaft, or by rotating the stub cap cover one-half turn and reversing the relief valve. Reversing rotation and repositioning the stub cap does not change direction of flow.

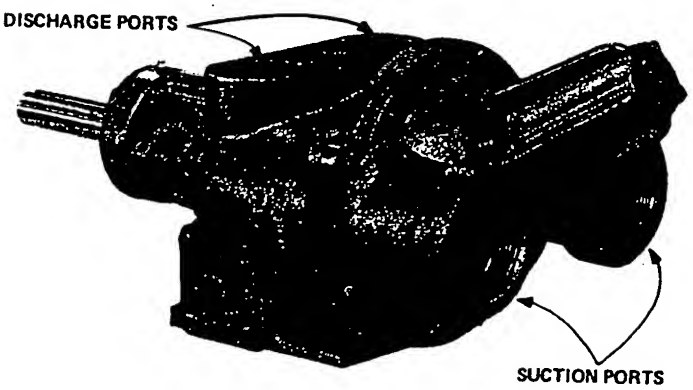

Fig. 3. Dual suction and discharge ports may be used for blending from separate suction lines, for flushing with a normally unused line, discharging into two separate areas, or plumbing for two separate, but compatible batch operations.

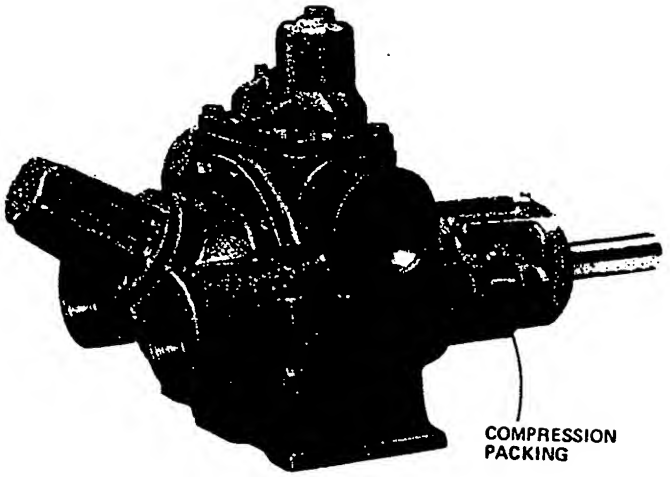

Fig. 4. Operating pressure is 200 psig for each of three sizes of pumps: 12, 20 and 50 gal per 100 rpm. Maximum recommended speeds are 750 rpm for the two smaller sizes and 600 rpm for the large unit. The temperature limit is 400 F for standard construction and 212 F when a mechanical seal is used.

shaft and the horizontal plane of the main pump shaft, Fig. 4. A 20 deg cover establishes the stub-to-main shaft angle at 20 deg, reducing the amount of rotor cavity closure by 33 percent.

A typical industrial application for rotary ball pumps is the transfer of urethane carpet backing. The pump was considered because of its ability to handle highly viscous, shear-sensitive materials. An unknown was the pump's ability to withstand the moderate to severe abrasion caused by solids entrained in the urethane. General conditions for this service:

Discharge pressure:	30 to 75 psig
Suction pressure:	−4 to +1 psig
Flow rate:	12 to 50 gpm
Viscosity:	approximately 41,000 SUS
Duty:	intermittent over an 8 hr day
Solids content:	up to 70 percent by weight
Particle size:	20 to 80 microns
Temperature:	plant ambient, 60 to 80 F

The most effective pump, before installation of a rotary ball pump, had been a progressing cavity type with a stainless steel rotor and urethane stator. This unit proved unsatisfactory because the rotor was worn down to a nondisplacing shaft after 2 to 3 months in operation. The rotary ball pump operated 13 months before bushing replacement was required. Rotor replacement has not yet been required.

The rotary ball pump cost was approximately one-tenth the price of the progressing cavity pump, and performed six times longer.

This application underscores an inherent problem when abrasive materials are handled with any positive displacement pump. The abrasive wear gradually diminished the pump's displacement capacity. The rate of wear depends upon the interrelationship of many factors: product viscosity; particle size, shape, and hardness; amount of solids; discharge pressure; operating speed; and internal pump slippage. Rotary ball pumps perform well on many abrasive services as long as the discharge pressure remains less than 75 psig. At pressures greater than 75 psig wear may accelerate rapidly. This abrasive wear threshold cannot be precisely determined before pump operation.

A 10 deg cover reduces the amount of rotor cavity closure by another 33 percent for a total reduction of 66 percent. This reduction in cavity closure allows the pump to handle larger suspended solids. However, reducing the amount of closure also reduces the flow by an equivalent amount, either 33 or 66 percent, when speed remains constant.

For example, a 2 in. pump delivering 60 gpm at 500 rpm with a 30 deg cover will deliver 39.6 gpm with a 20 deg cover and 19.8 gpm with a 10 deg cover.

The 20 and 10 deg cover angles are used for pumping wine musk, chocolate, tomato and peanut pastes, dog foods, cow manures for methane production, and coal-oil mixtures. One major project has been the successful pumping of a combination of waste oils, solvents, and ultrafine coal at the Brookhaven National Laboratory for the Federal Department of Energy.

The ability to change cover angles and thereby modify discharge rates has another advantage. An existing pumping system with fixed speed, power, and torque limits can be used to pump many fluids with varying viscosities. The speed, power, and torque limits can be adhered to by increasing or decreasing the amount of rotor cavity closure to control flow rates. A batch plant system designed to pump glycerin could also be used to pump coconut oil at higher flow rates and polyester resin at lower flow rates.